

CLAIMS

What is claimed is:

1. A system for injecting spin-based electrons into silicon, comprising:
 - 5 a ferromagnetic metal contact capable of transmitting carriers having a primary spin polarization; and
 - 10 a silicide layer positioned between the ferromagnetic metal contact and the silicon, the silicide layer making ohmic contact with the silicon such that the spin-polarized carriers transmitted from the ferromagnetic metal contact can be injected into the silicon without altering the primary spin polarization.
 2. A system according to claim 1, further comprising:
 - 15 a silicon substrate, the silicide layer being disposed on a surface of the silicon substrate and acting as a tunneling junction between the ferromagnetic metal contact and the silicon substrate.
 3. A system according to claim 1, wherein:
 - 20 the ferromagnetic metal contact and silicide layer form a source electrode.
 4. A system according to claim 1, further comprising:
 - 25 a drain electrode contacting the silicon, the drain electrode including a ferromagnetic detection contact capable of receiving the spin-polarized carriers, and further including a second silicide layer disposed between the ferromagnetic detection contact and the silicon substrate such that the spin-polarized carriers flowing into the ferromagnetic detection contact from the silicon substrate maintain spin polarization.
 5. A system according to claim 1, further comprising:
 - 30 a gate electrode positioned on the silicon substrate, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate such that spin-injected carriers flowing through the electric field tend to change spin orientation.

6. A system according to claim 1, further comprising:
an external field generator capable of applying an electric field across the
silicon such that spin-injected carriers flowing through the electric field tend to
change spin orientation.

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7. A system according to claim 1, further comprising:
a nanowire polygate positioned adjacent the silicon and capable of applying a
magnetic field across the silicon such that spin-injected carriers flowing through the
electric field tend to change spin orientation.

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8. A system according to claim 1, wherein:
the silicide layer is a cobalt silicide layer.

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9. A system according to claim 1, wherein:
the silicide layer is a nickel silicide layer.

10. A system according to claim 1, wherein:
the ferromagnetic metal contact is a cobalt ferromagnetic metal contact.

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11. A system according to claim 1, wherein:
the ferromagnetic metal contact is a cobalt ferromagnetic metal contact.

12. A spin-based transistor, comprising:
a silicon substrate;
a source electrode on the silicon substrate, the source electrode including a
ferromagnetic injection contact capable of injecting spin-polarized carriers into the
silicon substrate, and further including a first silicide layer disposed between the
ferromagnetic injection contact and the silicon substrate such that carriers injected
25 into the silicon substrate maintain spin polarization;

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a drain electrode on the silicon substrate, the drain electrode including a ferromagnetic detection contact capable of receiving spin-polarized carriers, and further including a second silicide layer disposed between the ferromagnetic detection contact and the silicon substrate such that carriers flowing into the ferromagnetic detection contact from the silicon substrate maintain spin polarization; and

10 a gate electrode positioned on the silicon substrate between the source electrode and gate electrode, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate between the source and gate electrodes such that carriers flowing through the electric field will change spin orientation.

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13. A method for forming a contact for a spin-based device, comprising:
depositing a first ferromagnetic metal layer on a silicon substrate;
annealing the first ferromagnetic metal layer to form a layer of metal silicide,
the layer of metal silicide having a thickness allowing the layer to act as a tunneling
junction for spin-polarized carriers; and

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forming a second ferromagnetic layer on the layer of metal silicide, the second ferromagnetic layer operable as a ferromagnetic contact capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

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14. A method according to claim 13, wherein:

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annealing the ferromagnetic metal layer to form a layer of metal silicide includes annealing a first portion of the first ferromagnetic metal layer, the metal silicide being in contact with the silicon layer, and

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forming a second ferromagnetic layer includes not annealing a second portion of the first ferromagnetic layer in order to form a ferromagnetic metal contact, the ferromagnetic metal contact overlying the layer of metal silicide and capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

15. A method according to claim 13, wherein:
5 forming a second ferromagnetic layer includes depositing a second ferromagnetic metal layer on the layer of metal silicide, the second ferromagnetic layer operable as a ferromagnetic contact capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

10 16. method according to claim 13, further comprising:
etching the layer of metal silicide to remove any unnecessary metal silicide.

15 17. method according to claim 13, further comprising:
applying a magnetic field to the second ferromagnetic layer in order to control the spin-polarization of the second ferromagnetic layer.

20 18. method according to claim 13, wherein:
annealing the first ferromagnetic metal layer to form a layer of metal silicide and forming a second ferromagnetic layer on the layer of metal silicide forms a source electrode for injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate.

25 19. method according to claim 13, wherein:
annealing the first ferromagnetic metal layer to form a layer of metal silicide and forming a second ferromagnetic layer on the layer of metal silicide forms a drain electrode for receiving spin-polarized carriers from the silicon substrate through the layer of metal silicide.

30 20. method according to claim 13, further comprising:
depositing a gate electrode on the silicon substrate, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate such that spin-polarized carriers flowing through the electric field will change spin orientation.